REMARKS

Support for the above-requested amendments to claim 1 is found at least in paragraph [0021]. Support for the amendments to claims 21 and 24 are found at least in paragraphs [0009] and [0021]. Claims 2 – 6 and 8 – 13 were amended for grammatical reasons and were not amended for any reasons related to patentability. Claim 22 has been canceled without prejudice. Claim 24 has been amended to correct an inadvertent typographical error and has not been amended for any reasons related to patentability. No question of new matter arises and entry of the above-requested amendments is respectfully requested.

Claims 1 – 16, 21, and 23 - 24 are before the Office for consideration.

Objection to Claim 24

Claim 24 has been objected to because the word "intercalated" is misspelled. In response to this objection, Applicants have amended claim 24 to correct this inadvertent spelling error. Accordingly, Applicants respectfully request that this objection be reconsidered and withdrawn.

Rejection of Claims 1 – 23 under 35 U.S.C. §112, first paragraph

Claims 1 – 23 have been rejected under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement. In particular, the Office asserts that the phrase "monomodal cell size distribution" is not supported by the present specification. In response to this rejection, Applicants have removed the term "monomodal" from the claim. Accordingly, Applicants respectfully request that the Office reconsider and remove this rejection.

Rejection of Claims 1 and 21 – 24 under 35 U.S.C. §102(b)

Claims 1 and 21 – 24 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,394,460 to Chung *et al.* ("Chung"). The Office asserts that Chung teaches a method of manufacturing a foam that includes (1) incorporating nanoparticles and a blowing agent into a melt under a first temperature and a first pressure, (2) extruding the polymer melt under a second temperature and second pressure to allow the polymer melt to expand and foam, and (3) cooling the foamed product to produce a monomodal foam with a

cell size of less than 100 microns, where the polymer melt includes an alkenyl aromatic polymer material.

In response to this rejection, Applicants respectfully direct the Office's attention to the amendments made to claims 1, 21, and 24 and submit that independent claims 1, 21, and 24, as amended, define methods of manufacturing a rigid foam that are not taught within Chung. Chung teaches a foam composition that includes an ethylene-chlorotrifluoroethylene copolymer, a blowing agent, and a nucleating agent. (*See, e.g.*, Abstract and column 2, lines 46 – 62). Cell formation generally takes place in the matrix at temperatures above the melting point of the matrix. (*See, e.g.*, column 5, lines 51 – 53). After blending the copolymer, blowing agent, and nucleating agent, the mixed material is heated to above the melt temperature of the polymer under sufficient pressure to prevent foaming. (*See, e.g.*, column 5, lines 53 – 57). When the pressure is released, the foaming occurs. (*See, e.g.*, column 5, lines 57 – 58).

Applicants respectfully submit that that there is no teaching within Chung of a polymer melt that includes an alkenyl aromatic polymer material as required in amended claims 1, 21, and 24. In order for a reference to be anticipatory, each and every element of the claimed invention must be found within the four corners of the cited reference. Because Chung does not teach a polymer melt that includes an alkenyl aromatic polymer material or nano particles in a polymer melt where the nano particle has a particle size in at least one dimension less than 100 as required by claims 1, 21, and 24,Applicants submit that Chung is not an anticipatory reference. Therefore, Applicants submit that claims 1, 21, and 24 are not anticipated by Chung and respectfully request that this rejection be reconsidered and withdrawn.

Rejection of Claim 24 under 35 U.S.C. §102(b)

Claim 24 has been rejected under 35 U.S.C. §102(b) as being anticipated by EP 1,024,163 to Hayashi *et al.* ("Hayashi"). The Office asserts that Hayashi teaches the claimed method including incorporating nanoparticles of calcium carbonate to produce a foam with an average cell size of 200 – 1000 microns.

In response to the rejection, Applicants respectfully direct the Office's attention to the amendments to claim 24 and submit that independent claim 24, as amended, defines a method of manufacturing a rigid foam that is not taught within Hayashi. Hayashi teaches an extruded

polystyrene resin foam and a method of making such a foam where the cells constituting the foam comprise mainly smaller cells having a cell size of 0.25 mm or less, and larger cells having a cell size of 0.3 to 1 mm. (*See, e.g.*, column 3, lines 21 – 25; column 4, lines 16 – 21; column 12, lines 19 – 23; column 16, lines 19 – 22; and claim 5). The area of the smaller cells (*i.e.*, a cell size of 0.25 mm or less) accounts for 10 – 90% of a sectional area of the foam. (*See, e.g.*, column 3, lines 25 – 27 and column 4, lines 21 – 23). It is preferred that the larger cells have a cell size of about 0.4 – 0.7 mm. (*See, e.g.*, column 12, lines 53 – 54). In addition, it is preferred that the cells having a cell size of not more than about 0.25 mm and the cells having a cell size of about 0.3 – 1 mm are dispersed as uniformly as possible to impart a low thermal conductivity and an adequate bonding strength to the foam. (*See, e.g.*, column 12, lines 41 – 47).

Applicants respectfully submit that that there is no teaching within Hayashi of a polymer melt that includes an alkenyl aromatic polymer material or where the nano particle has a particle size in at least one dimension less than 100 as required in amended claim 24. In order for a reference to be anticipatory, each and every element of the claimed invention must be found within the four corners of the cited reference. Because Hayashi does not teach a polymer melt that includes an alkenyl aromatic polymer material or nano particles in a particle melt where the particle has a particle size in at least one dimension less than 100 as required by claim 24, Applicants submit that Hayashi is not an anticipatory reference. Therefore, Applicants submit that claim 24 is not anticipated by Hayashi and respectfully request that this rejection be reconsidered and withdrawn.

Rejection of Claims 1 - 16 under 35 U.S.C. §103(a)

Claims 1 – 16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 6,795,446 to Lee *et al.* ("Lee") or U.S. Patent No. 6,617,295 to Nitzsche ("Nitzsche"). The Office asserts that Grinshpun teaches a method of manufacturing a rigid foam that includes (1) incorporating nanoparticle fillers, calcium carbonate, or clays into a polymer, (2) incorporating a blowing agent into the melt under a first temperature and a first pressure, (3) extruding the polymer melt under a second temperature and second pressure, and (4) cooling the foamed product allow the polymer melt to expand the foam with a cell size ranging from 25 – 7000 microns. Grinshpun does not explicitly teach that the nanoparticle fillers are nano-

clays, intercalated or expanded graphite, or the particle size of the calcium carbonate. However, it is asserted that Lee and Nitzsche teach similar methods that disclose the use of nano-clays and calcium carbonate. The Office concludes that it would have been obvious to one of skill in the art to take the method of Grinshpun and modify it with the nano-clay additives taught by Lee or Nitzsche for the improvement of the physical properties of the foam.

In response to this rejection, Applicants respectfully direct the Office's attention to independent claim 1 and submit that claim 1 defines a method of manufacturing a rigid foam that is not taught or suggested within Grinshpun. Grinshpun teaches a method for preparing a foam structure that includes hollow, coalesced foam strands. (*See, e.g.*, Abstract and column 1, lines 8 – 11). Optionally, the foam structure may include solid, coalesced strands. (*See, e.g.*, column 1, lines 11 – 13). The first step of the process includes providing a foamable composition that includes a blowing agent composition and at least one film forming composition. (*See, e.g.*, column 1, lines 64 – 66 and column 13, lines 46 – 48). The foamable composition is preferably a foamable polymer. (*See, e.g.*, column 13, lines 48 – 49). In addition, the foamable composition is an olefinic homopolymer. (*See, e.g.*, column 13, lines 49 – 50). Optionally, the foamable composition may include at least one additive or modifier selected from fire retardant chemicals, stabilizers, antioxidents, colorants, permeability modifiers, plasticizers, static dissipative agents, anti-static agents, surfactants, and opacifiers. (*See, e.g.*, column 13, lines 54 – 61). The blowing agent composition must effect a foaming of the film forming composition. (*See, e.g.*, column 2, lines 43 – 44). The foamable composition is in a gel state. (*See, e.g.*, column 1, lines 66 – 67 and column 13, lines 53 – 54). Next, the foamable composition is extruded through a die that has a plurality of orifices, each of which forms a hollow extrudate. (*See, e.g.*, column 2, lines 1 – 3 and column 13, lines 61 – 63). The hollow extrudate is converted into foamed hollow extrudate strands at a temperature that promotes bubble stability. (*See, e.g.*, column 2, lines 4 – 6 and column 13, lines 66 – 67). The final step includes permitting the hollow strands to contact and adhere to each other to form a hollow, multistrand polymer foam extrudate. (*See, e.g.*, column 3, lines 7 – 11 and column 13, line 67 – column 14, line 4).

Applicants respectfully submit that Grinshpun does not teach or suggest forming a method of forming a rigid foam that includes (1) incorporating nano-clays, calcium carbonate, intercalated graphites, or expanded graphites in a polymer melt that have a particle

size in at least one dimension less than 100 , (2) incorporating a blowing agent into the polymer melt at a first temperature and pressure, (3) extruding the polymer melt at a second temperature and pressure to allow foaming, and (4) cooling the foam to form a foam product that has an average cell size that is greater than approximately 60 μm as claimed in amended claim 1. Although Grinshpun teaches a foamable composition that is extruded into a foamed product, the foamable composition does not teach or suggest the inclusion of a nano-particle nucleating agent having a particle size in at least one dimension less than 100 as required by claim 1. As discussed above, certain additives and modifiers may be included in the polymer composition (*see, e.g.*, column 13, lines 54 – 61). However, Grinsphpun is silent with respect to teaching that the nucleating agent has a particle size in at least one dimension of less than 100 . None of the recited modifiers are defined with a specific particle size. Nitzsche teaches a method for foaming a resin and a composition that may be used to induce foaming of a resin when passed through processing machinery. (*See, e.g.*, Abstract and column 1, lines 41 – 44). The method includes (1) blending a composition that includes a blowing agent, a filler, a surfactant, and a binder with a polymeric material to form a mixture, (2) processing the mixture in a polymeric processing apparatus, and (3) forming a molded article from the mixture. (*See, e.g.*, column 1, lines 60 – 66). Lee teaches the use of nano-sized particles to form a microcellular foam that has a high density and a small cell size (*e.g.*, less than 5 microns). (*See, e.g.*, Abstract). The disclosed method for forming a polymeric foam with such a small cell size includes (1) providing a mixture of a polymer, an organophilic clay, and a blowing agent and (2) processing the mixture so as to cause the formation of cells. (*See, e.g.*, column 2, lines 30 – 35). Neither of Lee or Nitzsche make up for the deficiencies of Grinshpun, such as, for example, the specific particle size of the nano-particles.

In addition, Applicants submit that there is no motivation for one of skill in the art to arrive at the presently claimed invention based on the disclosure of Grinshpun. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). One of ordinary skill in the art simply would not be motivated to arrive at the presently claimed

process that includes the incorporation of a nano-particle nucleating agent having a particle size in at least one dimension less than 100 that is selected from nano-clays, calcium carbonate, intercalated graphites, or expanded graphites based on the teachings of Grinshpun. As discussed *supra*, neither Lee nor Nitzsche make up for the deficiencies of Grinsphun with respect to the claimed elements of claim 1. Without some teaching or suggestion within the four corners of the reference, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

With respect to claims 2 - 16, Applicants submit that because independent claim 1 is not taught or suggested by Grinshpun, Lee, and Nitzsche and claims 2 – 16 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2 - 16 are also not taught by Grinshpun, Lee, and/or Nitzsche.

In light of the above, Applicants submit that claims 1 – 16 are not obvious over Grinshpun in view of Lee and Nitzsche and respectfully request that this rejection be reconsidered and withdrawn.

Rejection of Claims 21 - 23 under 35 U.S.C. §103(a)

The Office has rejected claims 21 – 23 under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 5,010,112 to Glicksman *et al.* ("Glicksman"). In particular, the Office asserts that Grinshpun teaches the claimed method with the exception of the shape of the calcium carbonate. Glicksman is cited as teaching that the calcium carbonate is acicular. It is concluded that it would have been *prima facie* obvious to one of ordinary skill in the art to use the acicular calcium carbonate for the purpose of improving the insulating properties of the foam.

Intially, Applicants submit that claim 22 has been canceled without prejudice, thereby rendering the rejection of claim 22 moot.

In response to the remaining rejection, Applicants respectfully direct the Examiner's attention to claim 1 and to the arguments presented above regarding the rejection of claims 1 - 16 under 35 U.S.C. §103(a) over Grinshpun and submit that claim 21 defines a method of manufacturing a rigid foam that is not taught or suggested by Grinshpun. In addition, Applicants submit that Glicksman fails to make up for the deficiencies of Grinshpun, namely the incorporation of a nano-particle nucleating agent having a particle size in at least one dimension less than 100 . Glicksman discloses a closed cell, rigid, polymer foam that is

formed with filler particles in the form of flakes or spheres dispersed throughout the foam. (*See, e.g.*, column 2, lines 44 – 46). The particles are formed of non-metallic, non-opaque materials coated with an opaque material such as graphite, aluminum, or carbon black. (*See, e.g.*, column 2, lines 46 – 48 and 59 - 62). The coated filler lowers the thermal conductivity and lowers the radiation heat transfer. (*See, e.g.*, Abstract and column 2, line 66 – column 3, line 1). Glicksman does not teach or suggest the particle size of the filler material. In fact, Glicksman is silent as to any particle sizing. Because claim 21 is not taught or suggested by Grinshpun, and because Glicksman adds nothing to the teachings of Grinshpun with respect to the inclusion of a nano-particle nucleating agent that has a particle size in at least one dimension less than 100 , Applicants submit that claim 21 is not taught or suggested by the combination of Grinshpun and Glicksman.

In addition, Applicants submit that there is no motivation for one of skill in the art to arrive at the presently claimed invention based on the disclosure of Grinshpun. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). One of ordinary skill in the art would not be motivated to arrive at the presently claimed process that includes the incorporation of an acicular nano-particle nucleating agent having a particle size in at least one dimension less than 100 based on the teachings of Grinshpun. As discussed *supra*, Glicksman does not make up for the deficiencies of Grinsphun with respect to the claimed elements of claim 21. Without some teaching or suggestion within the four corners of the reference, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness. Because claim 23 is dependent upon claim 21 and claim 21 is not taught or suggested by Grinshpun or Glicksman as discussed above, claim 24 is also non-obvious and patentable.

In view of the above, Applicants submit that claims 21 and 23 are not obvious over Grinshpun in view of Glicksman and respectfully request that the Office reconsider and withdraw this rejection.

Rejection of Claim 24 under 35 U.S.C. §103(a)

The Office has rejected claim 24 under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun *et al.* ("Grinshpun") in view of U.S. Patent No. 6,589,646 to Morgenstern ("Morgenstern") or U.S. Patent No. 6,617,295 to Nitzsche ("Nitzsche"). In particular, the Office asserts that Grinshpun teaches the claimed method with the exception of the particle size of the calcium carbonate. Morgenstern and Nitzsche teach the particle size of the calcium carbonate is preferably in the range of 10 to 1000 nanometers and that the particle size of the nucleating agent impacts the cell structure. The Office concludes that it would have been obvious to one of ordinary skill in the art to use the calcium carbonate taught by Morgenstern and Nitzsche in the method of Grinshpun because the particle size of the nucleating agent is a result effective variable for the cell structure. In addition, it is asserted that the particle size of the nucleating agent would have been readily optimized as is routinely practiced in the art.

In response to this rejection, Applicants respectfully direct the Examiner's attention to claim 24 and submit that claim 24, as amended, defines a method of manufacturing a rigid foam that is not taught or suggested by Grinshpun. Morgenstern teaches a composite layered sheet that includes at least one substrate layer and at least one functional layer that includes one or more blowing agents or nucleating agents. (*See, e.g.*, Abstract and column 2, line 64 – column 3, line 4). The substrate and functional layers preferably comprise polystyrene. (*See, e.g.*, column 2, lines 14 – 15). The blowing agents and nucleating agents used for the functional layer may be conventional chemical or physical blowing agents or nucleating agents (*e.g.*, barium sulfate, calcium carbonate, talc, and clay). (*See, e.g.*, column 2, lines 37 – 40 and 58 – 64). Nitzsche teaches a method for foaming a resin and a composition that may be used to induce foaming of a resin when passed through processing machinery. (*See, e.g.*, Abstract and column 1, lines 41 – 44). The method includes blending a composition that includes a blowing agent, a filler, a surfactant, and a binder with a polymeric material to form a mixture, processing the mixture in a polymeric processing apparatus, and forming a molded article from the mixture. (*See, e.g.*, column 1, lines 60 – 66). Although Nitzshe teaches a preferred particle size of 0.01 – 1.0 μm, this is outside the claimed particle size of less than about 100 . Thus, neither Morgenstern nor Nitzsche teach or suggest the particle size of the nano particles. Thus, Applicants submit that Morgenstern and Nitzsche fail to make up for

the deficiencies of Grinshpun, namely the incorporation of a nano-particle nucleating agent having a particle size in at least one dimension less than 100 . Therefore, Applicants submit that independent claim 24 is patentable and non-obvious. In addition, Applicants submit that the combination of the Examiner's cited references would not result in the presently claimed invention.

Further, Applicants submit that there is no motivation for one of skill in the art to arrive at the presently claimed invention based on the disclosures of Grinshpun, Morgenstern, and Nitzsche. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g., Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 3, August 2005, §2142). One of ordinary skill in the art would not be motivated to arrive at the presently claimed process that includes the incorporation of at least one nano-particle nucleating agent having a particle size in at least one dimension less than 100 based on the teachings of Grinshpun, Morgenstern, and Nitzsche. As discussed *supra*, Morgenstern and Nitzsche do not make up for the deficiencies of Grinsphun with respect to the claimed elements of claim 24. Without some teaching or suggestion within the four corners of the reference, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

In view of the above, Applicants submit that claim 24 is non-obvious and patentable and respectfully request that the Office reconsider and withdraw this rejection.

CONCLUSION

In light of the above, Applicants believe that this application is now in condition for allowance and therefore request favorable consideration.

If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Application No. 10/722,929
Attorney Docket No: 25226A

If necessary, the Commissioner is hereby authorized to charge payment or credit any overpayment to Deposit Account No. 50-0568 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

Date: 9-8-06

Maria Gasaway
Registration No. 51,721

Owens Corning
Patent Department, Bldg. 11
2790 Columbus Road
Granville, Ohio 43023
(740) 321-7213